

OM-CAROUSEL  
Rev. 2  
23/01/19

## Owner's Manual

Dart 4 Hook Carousel  
Dart 6 Hook Carousel  
Dart 8 Hook Carousel

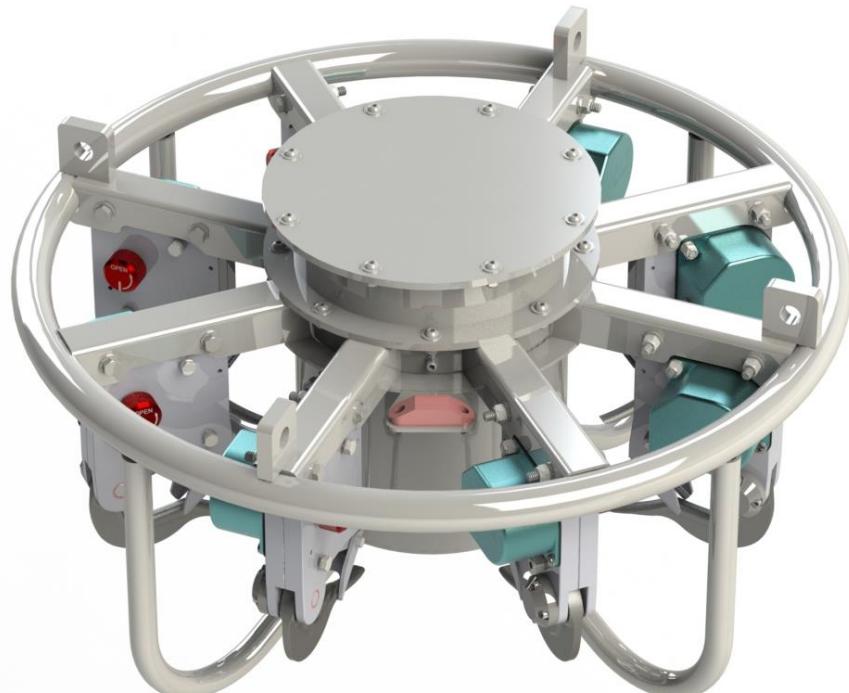


Figure 1: Dart 8 Hook Carousel (C2-8HC)



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## DETAILS OF REVISIONS

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## SECTION 1.0: INTRODUCTION

The Carousel has been designed to engage, lift, transport, and release external loads off a long line cable suspended from a helicopter. The Carousel Switching System has been designed to allow the operator the ability to release a single load or all loads from a multiple load cargo system.

The Carousel utilizes C2 Remote Cargo Hooks mounted on a cage. For details on the C2 Remote Cargo Hook, refer to the C2 Remote Cargo Hook Owner's Manual.

This Carousel Owner's Manual assumes the operator has purchased an entire system, which includes a carousel, hooks, and switching system. The information contained in this manual is intended to help the operator understand the principles and requirements for operating the system properly.

**WARNING:** Use only as a Long Line Hook! The Carousel is not certified as a primary or belly hook attached directly to the helicopter.

### 1.1 PRODUCT FEATURES

- The Carousel has three configurations: 4 Hook, 6 Hook, and 8 Hook.
- The solid-state design of the switching system makes it vibration and shock proof.
- The carousel is designed for easy operation and maintenance.
- There are only three leads necessary to power and operate the complete system, making installation simple.
- The lights are located on the cage to indicate hook release.
- The auto dump feature releases all loads quickly and sequentially.
- Surge suppression.
- Built-in safety feature to prevent the inadvertent release of a load.
- Water resistant.

## 1.2 PRECAUTIONS

The following precaution definitions will be used to indicate the seriousness of the hazard or condition

**WARNING:** May be a maintenance procedure, practice, condition, etc., which could result in personal injury or loss of life.

**CAUTION:** May be a maintenance procedure, practice, condition, etc., which could result in damage or destruction of equipment.

**NOTE:** May be a maintenance procedure, practice, condition, or a statement that needs to be highlighted.

## 1.3 DEFINITIONS

The following terminology will be used to describe defects and imperfections:

CORROSION:	Chemical action on the surface either resulting in discoloration, a surface of oxide or in an advanced degree of removal of the original surface metal.
CRACK:	Fissure, which does not quite separate the metal.
DENT/NICK:	Depression of surface metal without removal of material.
DISTORTION:	Deviation from original shape.
SCRATCH:	Narrow, shallow marks or lines resulting from movement of a particle or object across a surface.

## 1.4 WARRANTY

Dart Aerospace will warranty the product for workmanship for a period of 1 year. Internal components installed and manufactured from other manufactures are not covered by Dart Aerospace and are subject to OEM warranties. Dart Aerospace reserves the right to evaluate the product and determine if the unit is subject to warranty.

## SECTION 2.0: TECHNICAL DATA

### 2.1 CAROUSEL

The maximum lift capacity given below applies to the Dart 4, 6, and 8 Hook Carousels. This value may be applied to one individual hook, or distributed among whichever hooks are being used.

Maximum Lift Capacity: 2000 lb.

#### 2.1.1 4 HOOK CAROUSEL:

Fully Assembled Weight: 100 lb.

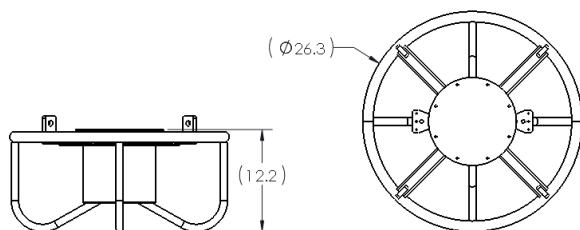


Figure 2: Front and Top View of the 4 Hook Carousel Cage (C2-4HC) shown without hooks.

#### 2.1.2 6 HOOK CAROUSEL:

Fully Assembled Weight: 110 lb.

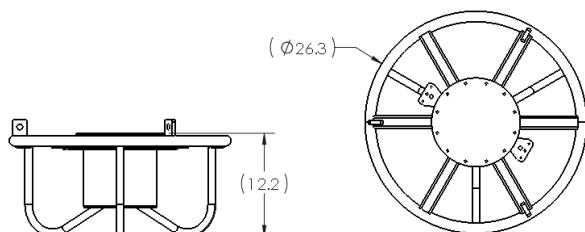


Figure 3: Front and Top View of the 6 Hook Carousel Cage (C2-6HC) shown without hooks.

#### 2.1.3 8 HOOK CAROUSEL:

Fully Assembled Weight: 120 lb.

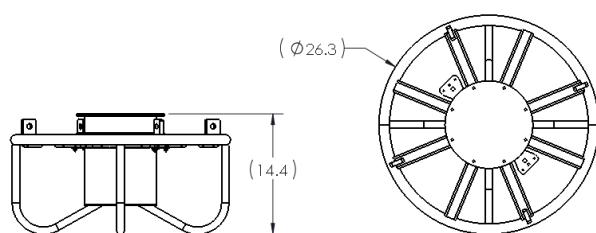


Figure 4: Front and Top View of the 8 Hook Carousel Cage (C2-8HC) shown without hooks.

## 2.2 SWITCHING SYSTEM

The switching system is designed to operate with the use of 24 VDC with a maximum current of 15 Amps. The switching system has been tested to release at 16 VDC with a 4 Amp draw. Table 1 below references what switching system is used on each carousel.

Table 1: Carousel and Switching System Identification

Carousel	Switching System
C2-4HC	D104-AB
C2-6HC	D106-AB
C2-8HC	D108-AB

### 2.2.1 CIRCUIT BOARD

Operating Temperature: -22 °F to +176 °F (-30 °C to +80 °C)  
Input Voltage Range: 11 to 28 VDC

### 2.2.2 RELAYS

Operating Voltage Range: 0 to 100 VDC  
Input Voltage Range: 3.5 to 32 VDC  
Operating Temperature: -22 °F to +176 °F (-30 °C to +80 °C)  
Max Load Current: 40 Amps  
Min Load Current: 20 mAmps

### 2.2.3 WIRING

16 AWG aviation grade wires for all relay and hook connections.  
22 AWG aviation grade wires for all board connections.

**2.2.4 HOUSING DIMENSIONS:**

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D104-AB and D106-AB share identical switching system housing dimensions.

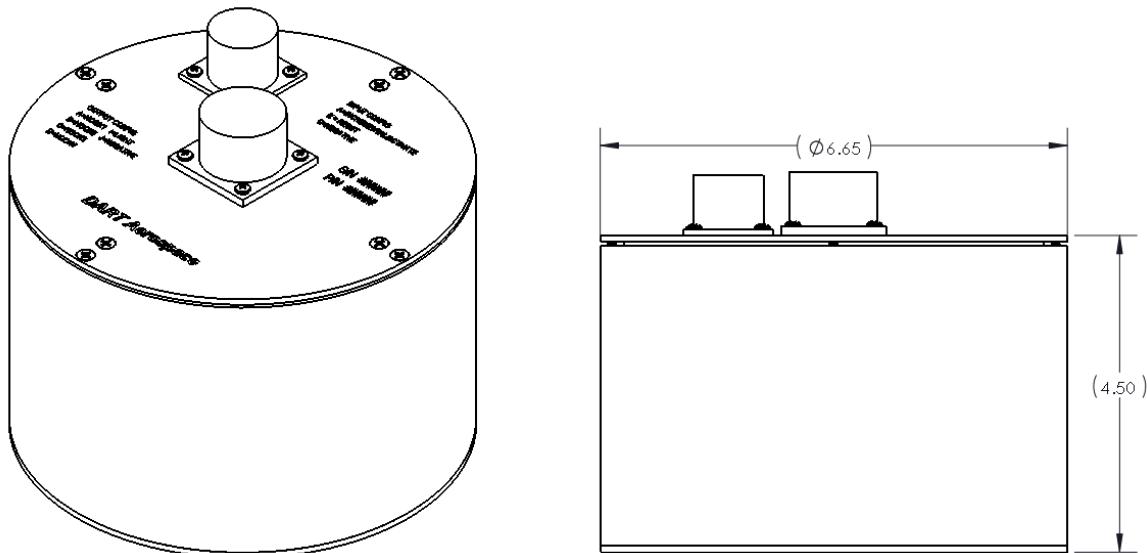


Figure 5: D104-AB and D106-AB Switching System Dimensions.

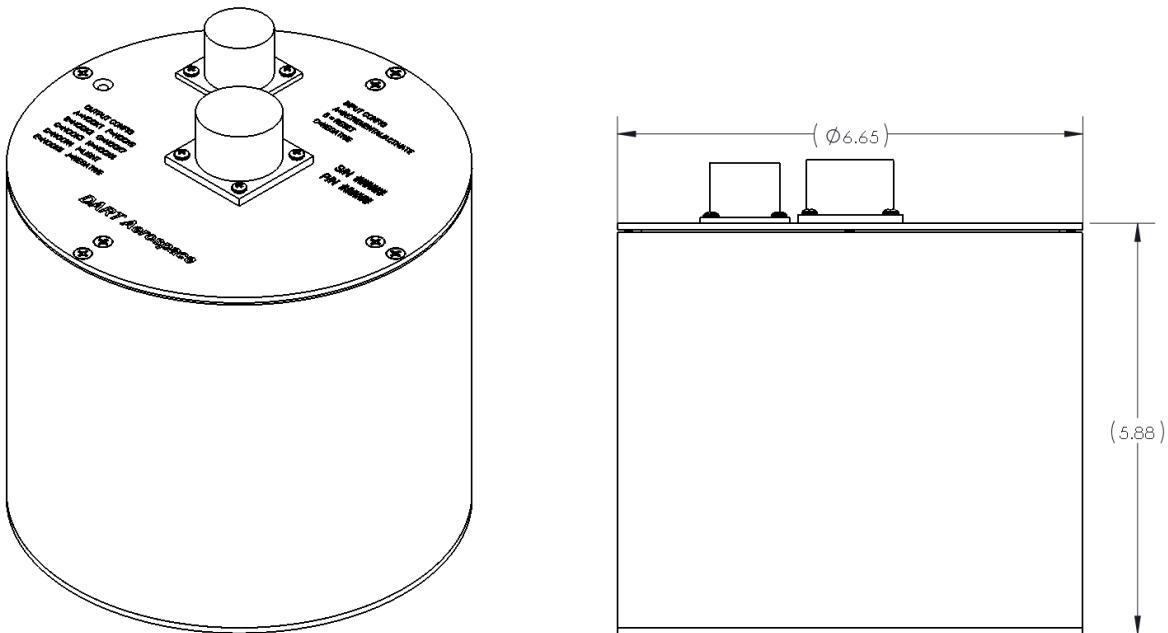


Figure 6: D108-AB Switching System Dimensions.

## SECTION 3.0: ELECTRICAL SYSTEM

The system is only energized when the activate/release button is pressed. The switching system circuit board has been designed with the intent of not having to be constantly powered. The switching circuit board controls the solid-state relays to trigger the lights and hooks. The system is designed to operate with the use of 24 VDC power supply with a maximum current of 15 Amps.

### 3.1 HELICOPTER SIDE

To complete the circuit inside the aircraft to operate the Carousel, the operator is required to install a DPDT momentary (Mom-Off-Mom) switch (or two normally open SPST momentary switches) rated for 24 VDC and 20 Amps.

### 3.2 LONG LINE

The maximum length of the line should not exceed 200 ft. Minimum 14 AWG wire with a three pronged 20 Amp rated connector is required.

- Green Lead = Reset (+24 VDC) / Female Plug Flat Spade (Brass Stud)
- White Lead = Activate/Release (+24 VDC) / Female Plug Flat Spade (Silver Stud)
- Black Lead = Negative (0 VDC, GND) / Female Plug "U" Prong (Green Stud)

**CAUTION:** BEFORE USING THE CAROUSEL, USE THE PROVIDED LONG LINE TEST BOX TO TEST FOR CORRECT POLARITY ON THE LONG LINE.  
SEE SECTION 6.0.

### 3.3 CAROUSEL

- The Carousel has a 3-prong Male connector to plug into the long line.
- The input to the switching system uses a 3-socket canon plug color coded as follows:
  - Green Lead = Reset / Canon Plug side A into system.
  - White Lead = Activate/Release / Canon Plug side B into system.
  - Black Lead = Negative / Canon Plug side C into system.
- The output from the switching system uses a 14 socket canon plug. The configuration for the output is marked on the lid of the switching system and reads as follows:
  - A = HOOK 1
  - B = HOOK 2
  - C = HOOK 3
  - D = HOOK 4
  - E = HOOK 5
  - I = LIGHT
  - J = NEGATIVE
- Each hook and the lights have the positive side wired to its corresponding switching system output canon plug socket and the negative side connected to the ground terminal bolt on the inside wall of the control box.

### 3.4 LIGHT INDICATOR RELAY

Each hook is controlled by its own, dedicated, relay. There is an additional relay required to trigger the lights on top of the Carousel. This relay will automatically activate every time the release of a hook is performed. The intention of the light is to indicate to the operator that a hook has been released.

## SECTION 4.0: CIRCUIT SCHEMATIC

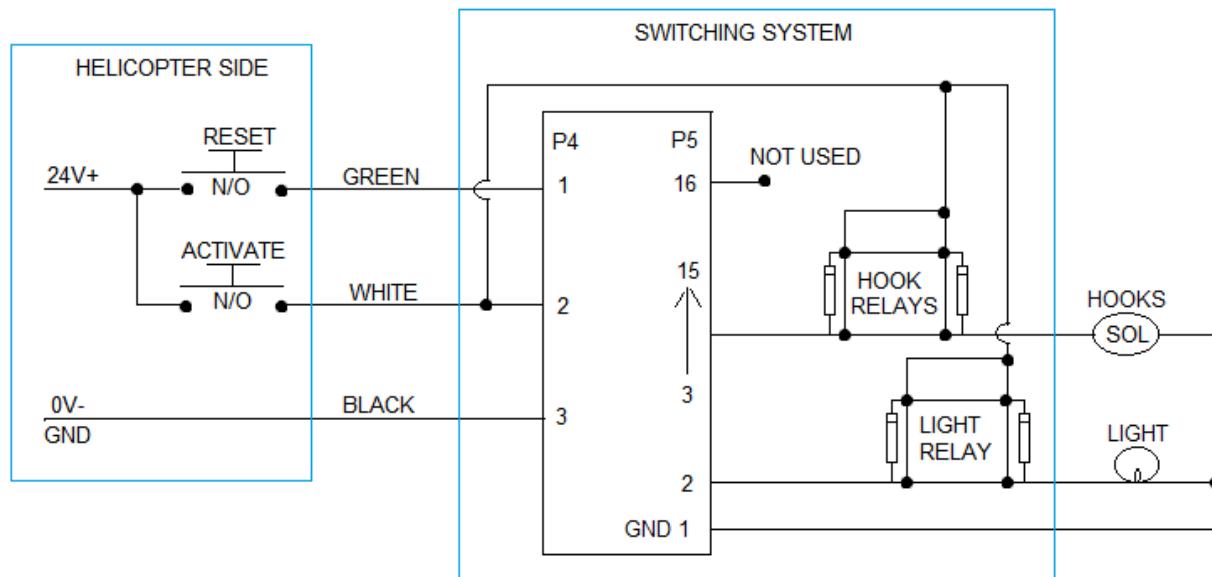


Figure 5: Carousel Circuit Schematic

## SECTION 5.0: OPERATION

A specific hook can be triggered by indexing to that hook position, then triggering the hook. The system will remain in the hook position it was last indexed to.

### 5.1 SAFETY FEATURES

Several safety features have been incorporated into the switching system and are as follows.

#### 5.1.1 DELAYED RELEASE:

The Advance/Release button needs to be activated for a minimum of one second to release a hook. This is done to prevent the inadvertent release of a load.

#### 5.1.2 REVERSE POLARITY PROTECTION:

The switching is polarity sensitive.

Bridge diodes have been installed to protect the system.

The system will not function if incorrect polarity is used.

The system will function properly once the correct polarity is used.

A Long Line Test Box is provided with every carousel to pretest each long line for correct polarity. Please consult Section 6.

### 5.2 LOAD ATTACHMENT

**WARNING:** Maximum load ring inner diameter is 2.5 inches for C2 Hooks. Consult hook owners manual before use.

**NOTE:** When a cable angle is flatter than 45°, a connector is recommended.  
Figure 8 shows examples.

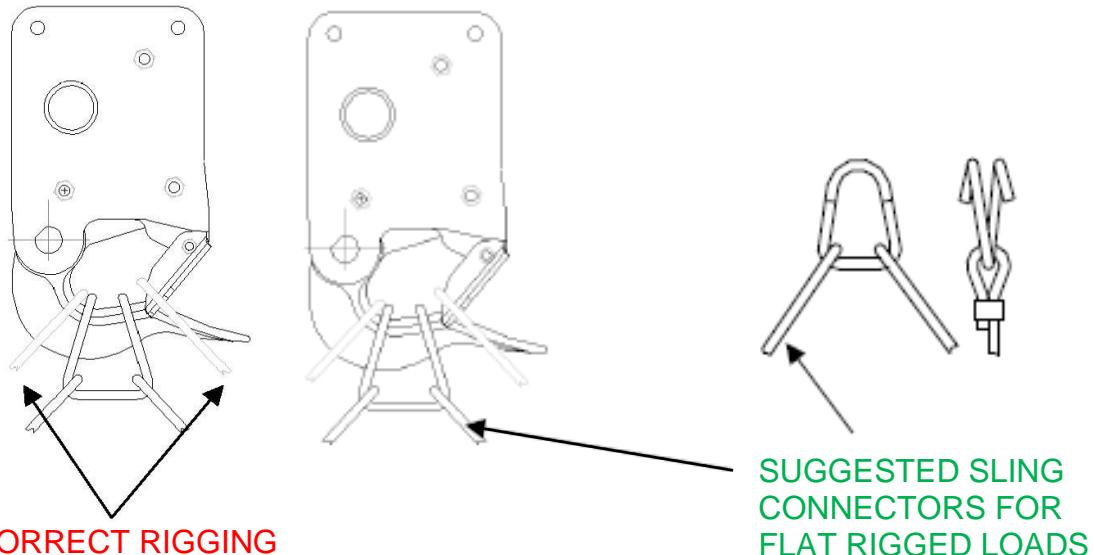


Figure 6: C2 Remote Cargo Hook incorrect and correct methods of rigging.

### 5.3 OPERATION OF THE ADVANCE/RELEASE AND RESET SWITCHES

- The indexing of a hook station is performed on the advance/release button. The operator will have to count the number of advance button pushes to know which hook is indexed.
- The triggering of a hook is performed at the push and one second hold of the advance/release button.
- The reset button indexes the system back to hook number one.

### 5.4 AUTO DUMP FEATURE

All of the hooks can be released at once, sequentially. At any time during operation if the activate/release button is activated for more than 5 seconds all of the hooks will quickly release from hook one to hook twelve.



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## 5.5 DIFFERENT HOOK AMOUNTS

The circuit board has the ability to accommodate up to 12 separate hooks. The same circuit board is used for all Carousel configurations. The board will always cycle up to and include the twelfth hook. The Carousel top lights will always illuminate when the advance/release button is triggered even if it isn't being used in a twelve hook configuration.

Example:

In an eight hook configuration, there would be four terminals on the board not in use. There are no relays attached to the board at the unused terminals so there is nothing for the board to activate. The indexing will still take place on those positions after hook eight. Once indexed to position nine and the button is triggered, the lights on top of the carousel will illuminate, but no hooks will be triggered.

## SECTION 6.0: LONG LINE TEST BOX

This tester is to be used as part of the installation procedure for a carousel. The tester is plugged into the electrical end of the long line prior to carousel installation for proper line polarity.

There are two light indicators: one marked SW 1 (switch 1) and the other SW 2 (switch 2). Both indicators have two possible active colors (red or green) that will illuminate when power is supplied to the tester.

- A RED LIGHT indication on either switch side indicates that the circuit is not properly connected and the polarity must be changed.
- A GREEN LIGHT indication on both switch sides (SW 1 and SW 2) indicates proper wiring polarity.

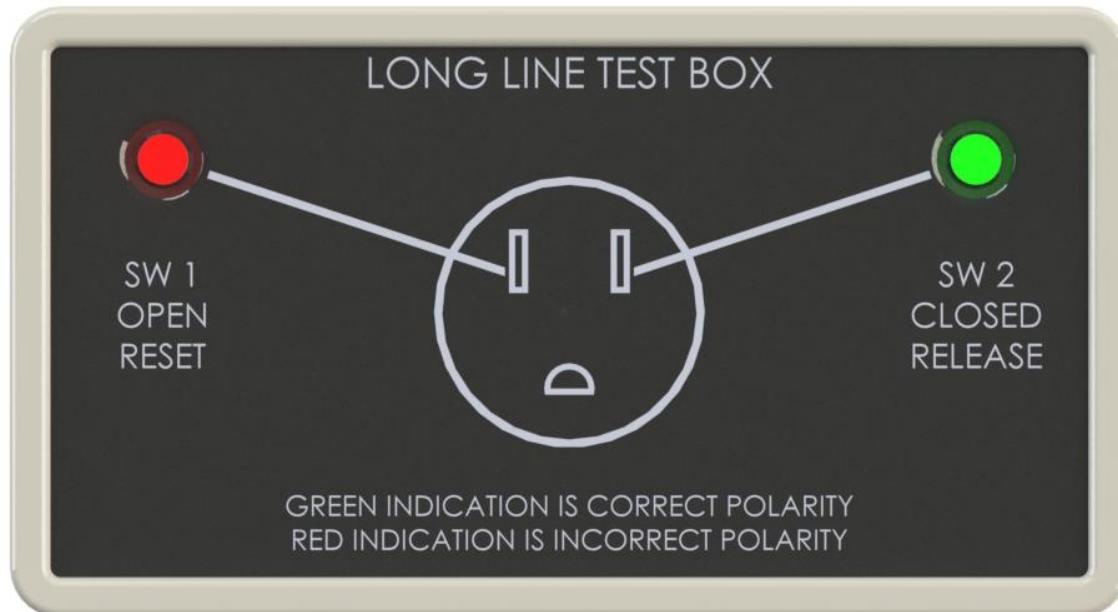


Figure 7: The image above shows a RED LIGHT indicating incorrect polarity for SW 1 and GREEN LIGHT indicating correct polarity for SW 2. This problem would be solved by changing the polarity of SW 1 so that both SW 1 and SW 2 light would be GREEN.

## SECTION 7.0: MAINTANANCE

### 7.1 CAROUSEL CAGE INSPECTION

Inspect the Carousel cage, wire rope assemblies, and the C2 Remote Cargo Hooks. Any component showing excessive wear, abuse, cracks, corrosion, or damage must be removed and replaced or repaired.

### 7.2 C2 REMOTE CARGO HOOK INSPECTION

Insure that the C2 Hook mechanism works by rotating the manual release knob while applying hand pressure to the Load beam. The Load beam should open smoothly without resistance. When the Load beam is closed the manual release knob should automatically and quickly return to its closed position.

When the C2 Remote Cargo Hooks are in use, clean them daily and apply grease to the nose of the load beam, where it engages the lock. The load beam nose should be smooth and free of burrs or divots.

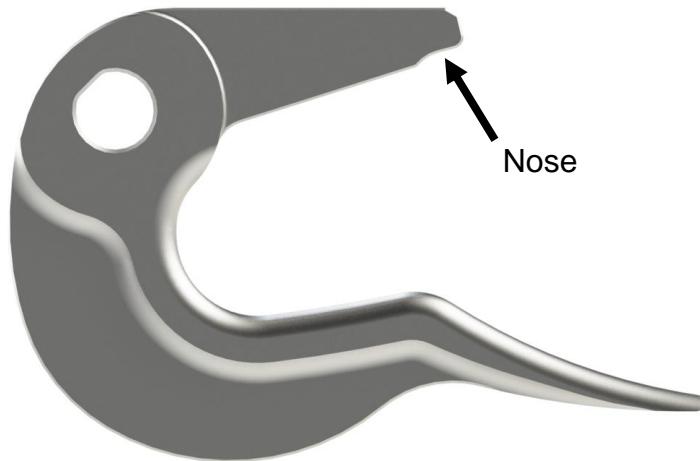


Figure 8: Load beam for the C2 Remote Cargo Hook.

The overhaul interval for all Dart Remote Cargo Hooks is 5 years or 1500 hrs. whichever comes first. Refer to the C2 Remote Cargo Hook Owner's Manual for detailed maintenance and overhaul procedures.

## 7.3 SWITCHING SYSTEM

### 7.3.1 REMOVAL

Removing the Carousel switching system from the control box of the carousel cage is not recommended. However, if it is necessary to remove the switching system:

- 1) Start by removing the eight (or twelve) screws that hold the control box lid in place.
- 2) The control box lid has been sealed with Pro Seal. Gently break the seal with a chisel and pry the control box lid off. Avoid damaging any of the hardware.
- 3) Inside the control box you will see two plugs on top of the switching system itself. Unscrew both plugs and remove foam and rubber bumpers.
- 4) Arrange wires to make room for removing the switching system and gently lift the switching system out of the carousel frame.

### 7.3.2 INSPECTION

- 1) Check carousel control box for signs of wear, corrosion, and water penetration.
- 2) Check the Switching System for any signs of wear and corrosion.

### 7.3.3 INSTALLATION

- 1) Arrange wires and install foam and rubber into the carousel cage control box leaving room for the switching system.
- 2) Gently insert the switching system into the carousel cage control box and connect the two wire leads.
- 3) Install final foam and rubber bumpers and check wires for tension and creasing.
- 4) Apply Pro Seal (or equivalent) around the surface that the switching system cover meets the carousel cage control box and reinstall the switching system cover using fasteners previously removed.
- 5) Installation Checks:

**NOTE:** Before using the carousel, use the provided Long Line Circuit Tester to test for correct polarity. Long Line Circuit Tester sheet provided in Section 6.

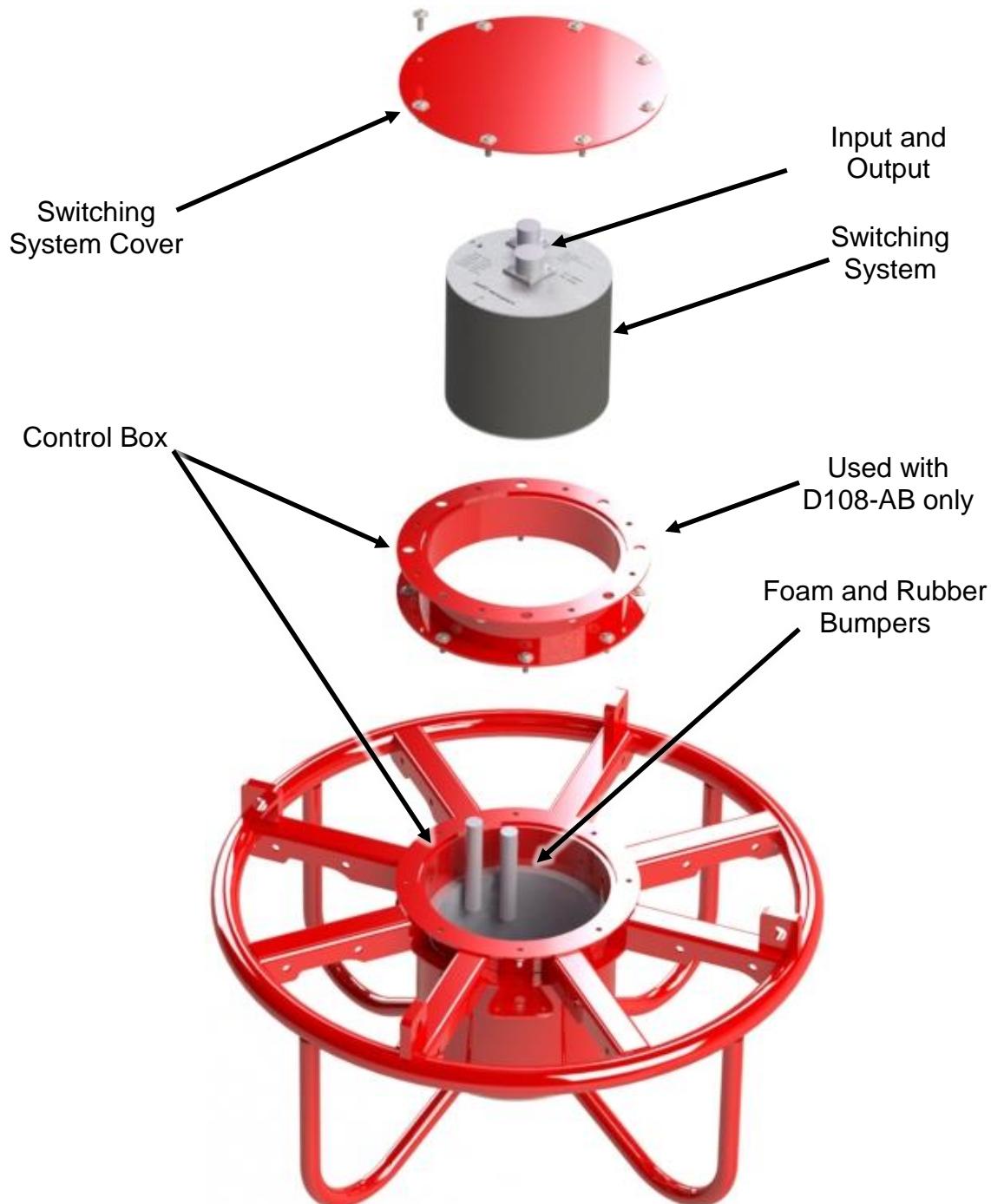


Figure 9: Exploded view of major components.

## SECTION 8.0: PARTS LIST

### 8.1 PARTS LIST TABLE

Table 2: Parts list for Carousels C2-4HC, C2-6HC, and C2-8HC

PART #	DESCRIPTION	QTY C2-8HC	QTY C2-6HC	QTY C2-4HC
C2-8HC-W	Cage Weldment, 8 Hook	1	-	-
C2-6HC-W	Cage Weldment, 6 Hook	-	1	-
C2-4HC-W	Cage Weldment, 4 Hook	-	-	1
C2-8HC-WA	Adapter Weldment	1	-	-
C2-8HC-008	Lid, Control Box	1	-	1
C2-6HC-008	Lid, Control Box, 6 Hook	-	1	-
C2-8HC-29	Foam Circle	1	1	1
C2-8HC-31	Foam Rectangle	1	1	1
C2-8HC-33	Post	2	-	-
C2-6HC-33	Post	-	2	2
D108-AB	Switching System, 8 Hook	1	-	-
D106-AB	Switching System, 6 Hook	-	1	-
D104-AB	Switching System, 4 Hook	-	-	1
C2	C2 Remote Cargo Hook	8	6	4
C2-8HC-35	Hex Head Cap Screw	16	12	8
C2-8HC-37	Washer	32	24	16
C2-8HC-39	Nylon Insert Hex Nut	16	12	8
C2-8HC-41	Button Head Socket Cap Screw	16	24	16
C2-8HC-43	Washer	32	48	32
C2-8HC-45	Nylon Insert Hex Nut	16	24	16
C2-8HC-47	Light	2	2	2
C2-8HC-49	Button Head Socket Cap Screw	4	4	4
C2-8HC-51	Washer	4	4	4
C2-8HC-53	Nylon Insert Hex Nut	4	4	4
C2-8HC-55	Grommet	2	2	2
C2-8HC-57	Circular Connector	1	1	1
C2-8HC-59	Back shell, Connector	1	1	1
C2-8HC-61	Circular Connector	1	1	1
C2-8HC-63	Back shell, Connector	1	1	1
C2-8HC-65	Male Plug	1	1	1
C2-8HC-71	Ring Terminal	11	9	7



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Table 2: Parts list for Carousels C2-4HC, C2-6HC, and C2-8HC cont.

PART #	DESCRIPTION	QTY C2-8HC	QTY C2-6HC	QTY C2-4HC
C2-8HC-73	Socket Head Cap Screw	1	2	1
C2-8HC-75	Split Lock Washer	2	4	2
C2-8HC-77	Hex Nut	2	4	2
C2-8HC-79	Cord Grip	1	1	1
C2-8HC-81	Cord Grip	10	8	6
C2-8HC-105	Wire Rope Assembly	1	-	1
C2-6HC-105	Wire Rope Assembly, 6 Hook	-	1	-

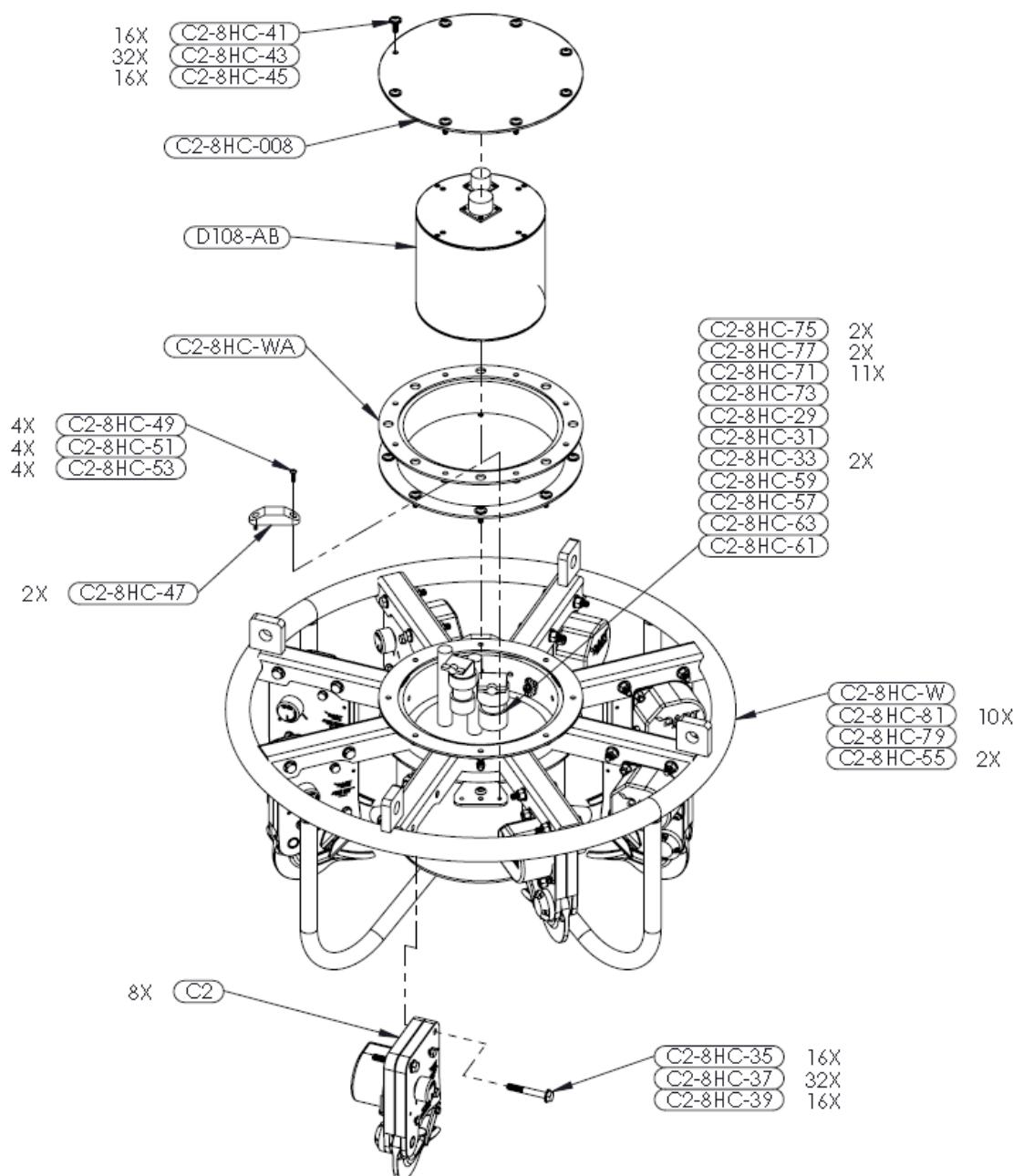


Figure 10: Exploded view of 8 Hook Carousel (C2-8HC). Check Table 2 (Section 8.1) for the assembly component differences between the 4 Hook, 6 Hook, and 8 Hook Carousels.